ENVIRONMENTAL ASSESSMENT
FOR
BRUSH WELLMAN, INC.
OPEN PIT BERYLLIUM MINE

ON

SECTIONS: 32/16

TOWNSHIP 12/13 SOUTH, RANGE 12 WEST

JUAB COUNTY, UTAH

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PREPARED BY:

UTAH DIVISION OF OIL, GAS, AND MINING

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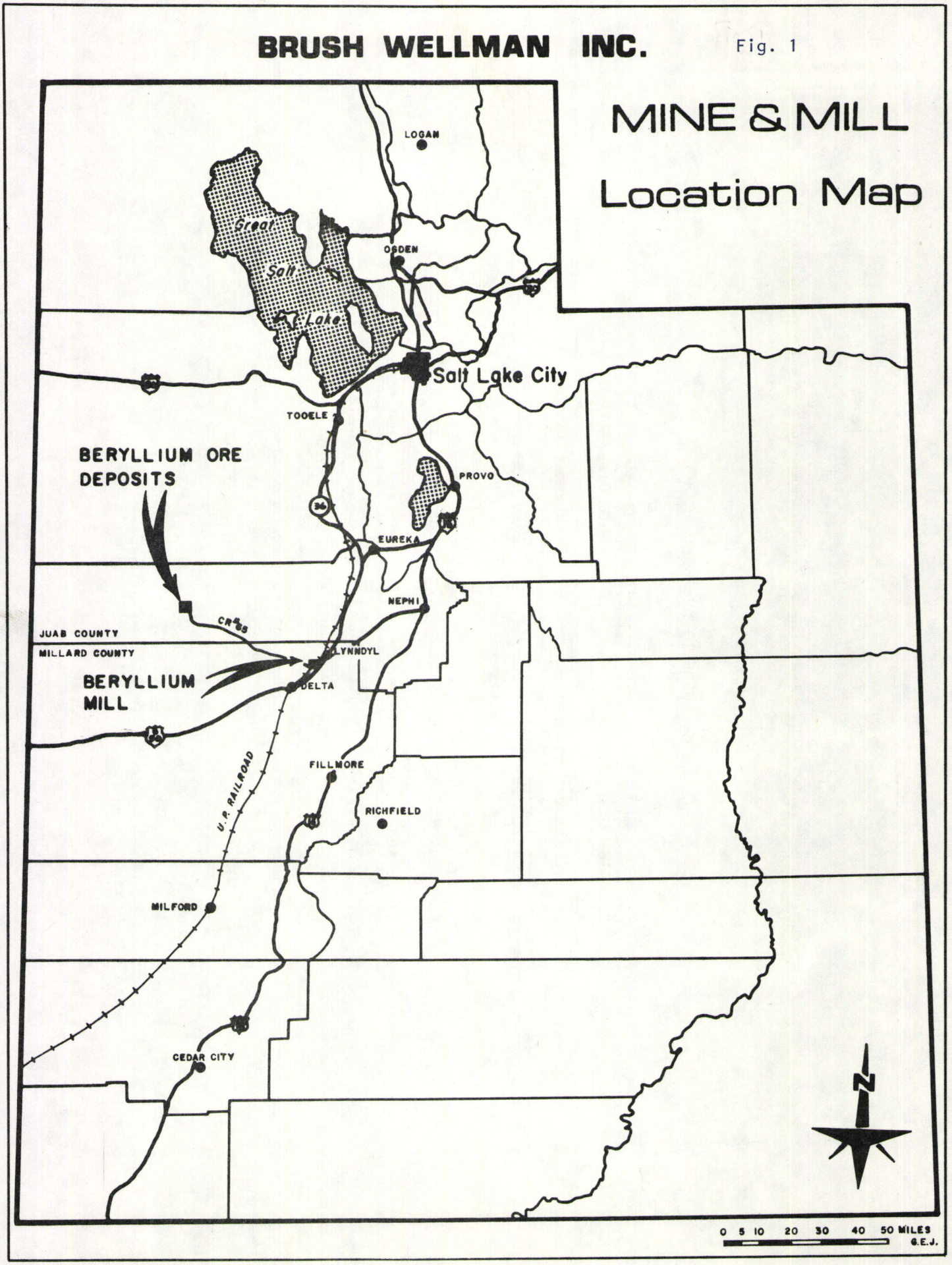
BRUSH WELLMAN INC.

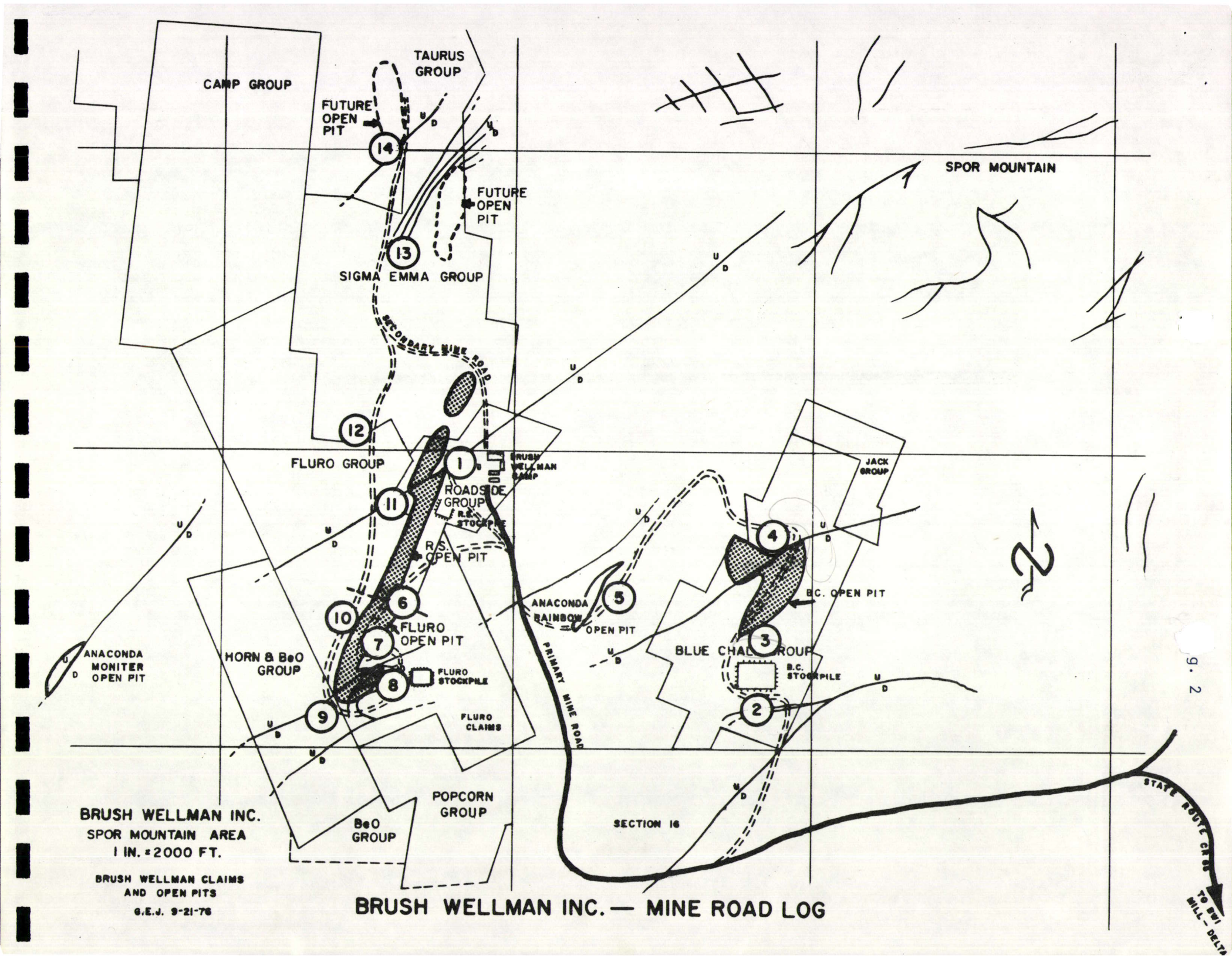
Fig. 1



MINE ROAD LOG - tour to be conducted over the company's mining properties

REFERENCE GUIDE TO NUMBERED ROAD LOG

1. Roadside Open-Pit
2. Blue Chalk Ore Stockpile
3. Blue Chalk Open-Pit
4. Blue Chalk Overlook
5. Anaconda Rainbow Open-Pit
6. Fluro and Roadside Boundary
7. Fluro Open-Pit
8. Fluro Ore Stockpile
9. Horn and Fluro Boundary
10. Fluro Overlook
11. Future Roadside Pits 2 & 3
12. Sigma Emma and Fluro Boundary
13. Proposed Sigma Emma Pit
14. Proposed Taurus Pit



BRUSH WELLMAN INC. — MINE ROAD LOG

I. LOCATION OF THE PROPOSED ACTION:

Brush Wellman, Inc., Mining Division of Salt Lake City is planning on developing an open pit Beryllium mine on each of two State sections in Juab County, Utah. One pit will be located in the south of Section 32, Township 12 South, Range 12 West, and one pit will be located in the NE/4 of Section 16, Township 13 South, Range 12 West. A small portion of another pit will be located in the southwest corner of Section 32.(Fig.1)

The mining area generally is located on the southwest slope of Spors Mountain, east of Fish Springs Flat and about 40 miles northwest of Delta. The general area is part of the Great Salt Lake Desert and is notable for its proximity to Topaz Mountain which is about five (5) miles east of the mines.

II. DESCRIPTION OF THE PROPOSED ACTION:

Brush Wellman, Inc., has controlled the largest Beryllium deposits in Utah since 1963 when Brush Beryllium purchased all Beryllium claims then owned by Vitro Minerals Corporation and Beryllium Resources, Inc. The present operation is developing what is known as the worlds largest Beryllium deposit. The low grade mineralization is best developed by open pit methods and this has been done by Brush at three present locations on mineral claims. (Fig.2)

The future pits on State lands will be operated the same as the present operations so the following description of the now active work will adequately describe the future actions that are the subjects of this environmental analysis.

The ore zone dips to the west under Fish Springs Flat which necessitates an asymmetric pit with a gradual east side and a steep west side. Brush contracts the overburden stripping to private excavating firms after

drilling out an ore body. (Fig.3) The overburden is deposited in areas selected to create the least adverse effect on the existing topography. The dumps are generally wide and low with rounded slopes at angles less than 45°. The hard blocky overburden is covered with relatively soft, fine overburden to a thickness of 12".

After the overburden is stripped off, Brush crews drill the ore body again at 25' centers to further define the ore grade for lifting. (Fig.4) From this data, detailed cross-sections are drawn at 25' intervals along the strike along with structure contour maps of the upper and lower cutoff grade surfaces.

The final stripping is done by Brush crews to expose the upper cutoff grade surface of the ore. This step is followed by a detailed elevation survey of this surface to establish control points. (Fig.5)

The ore body is then lifted out down to the lower cutoff surface and is spread in uniform lifts on top of one of the flattened overburden dumps. The ore stock piles are then drilled again on 20' centers, sampled and assayed in 2' intervals to identify grade distribution throughout the pile. (Fig.6) This is necessary to ensure a homogeneous ore feed to the concentrator at Delta which is between 0.6 and 0.7 % BeO.

The above described process is repeated about every four to five years. The present plans are to open the Taurus Pit in Section 32 during 1978. The proposed pit in Section 16 will probably not be opened for 10-15 years and the Camp Group Pit in the southwest corner of Section 32 is probably in the same priority situation as the Section 16 pit.

The present operation has been inspected by the Division of Oil, Gas, and Mining personell and a reclamation plan has been formulated that meets with the Division's approval. It consists of removing all unnecessary structures and debris along with replanting the dumps and footwalls of the pits. The highwalls will be protected by 4-5' high

OVERBURDEN REMOVAL-
STRIPPING OPERATIONS

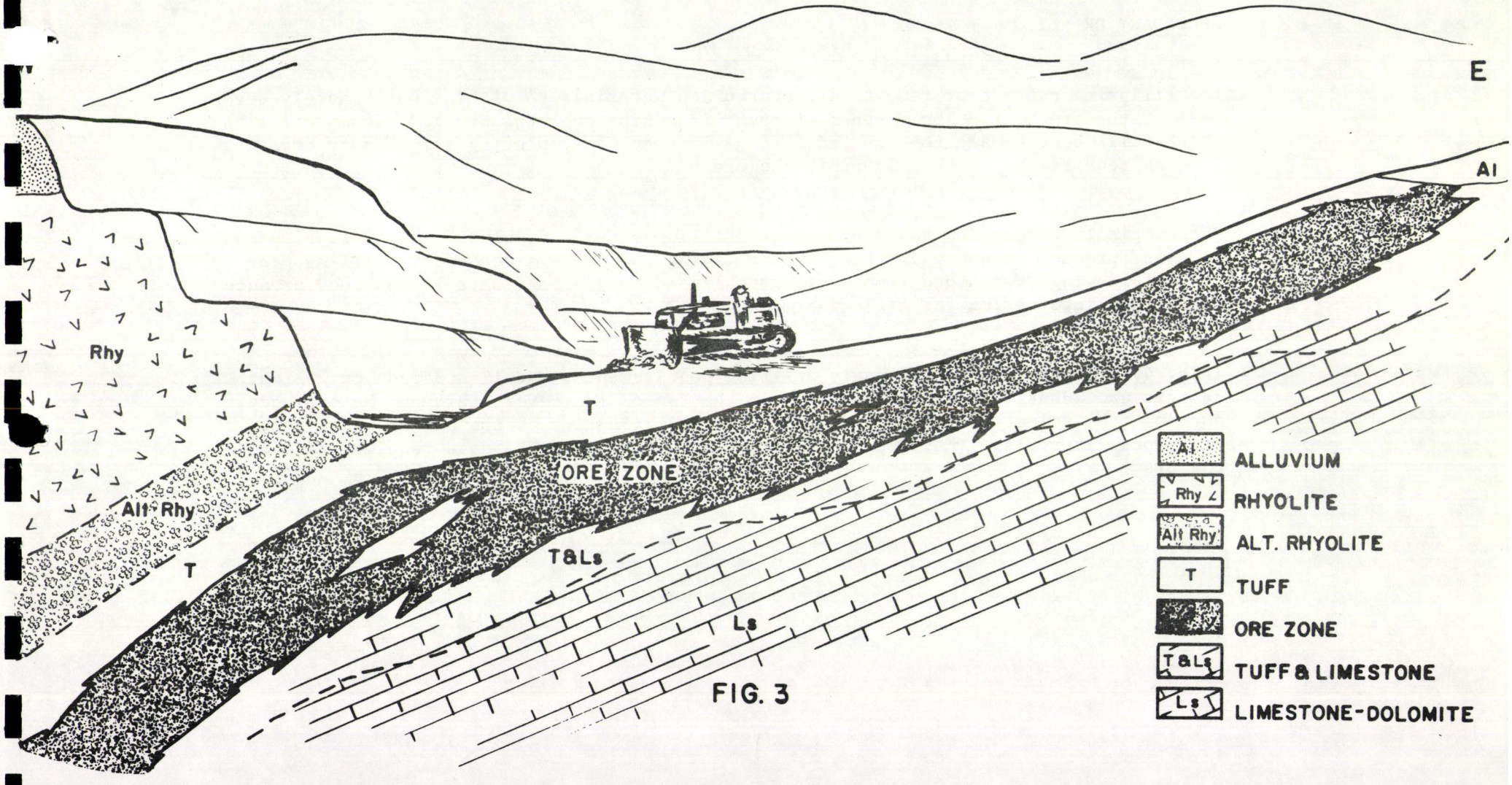


FIG. 3

SECONDARY DRILLING

The stripping contractor removes all overburden materials to within approximately seven feet of the ore body. The seven-foot cover remaining over the ore body is material in which drill benches are constructed for the purpose of completing a secondary drilling program required to further identify the ore body.

The original exploration and development drilling program completed on 100-foot spacing does not produce adequate information for mining the ore - a secondary drilling program, following overburden removal is established on 25-foot controls and does produce sufficient information for effective mining.

(Fig. 4) illustrates the secondary drilling requirements. Drill stations on 25-foot centers are identified. Drilling is from the top of the cover, through the ore body, and into the dolomitic-limestone (basement rock). Samples of the ore body are taken at 2-foot intervals. The samples are analyzed and produce the data required to mine the ore.

SECONDARY DRILLING

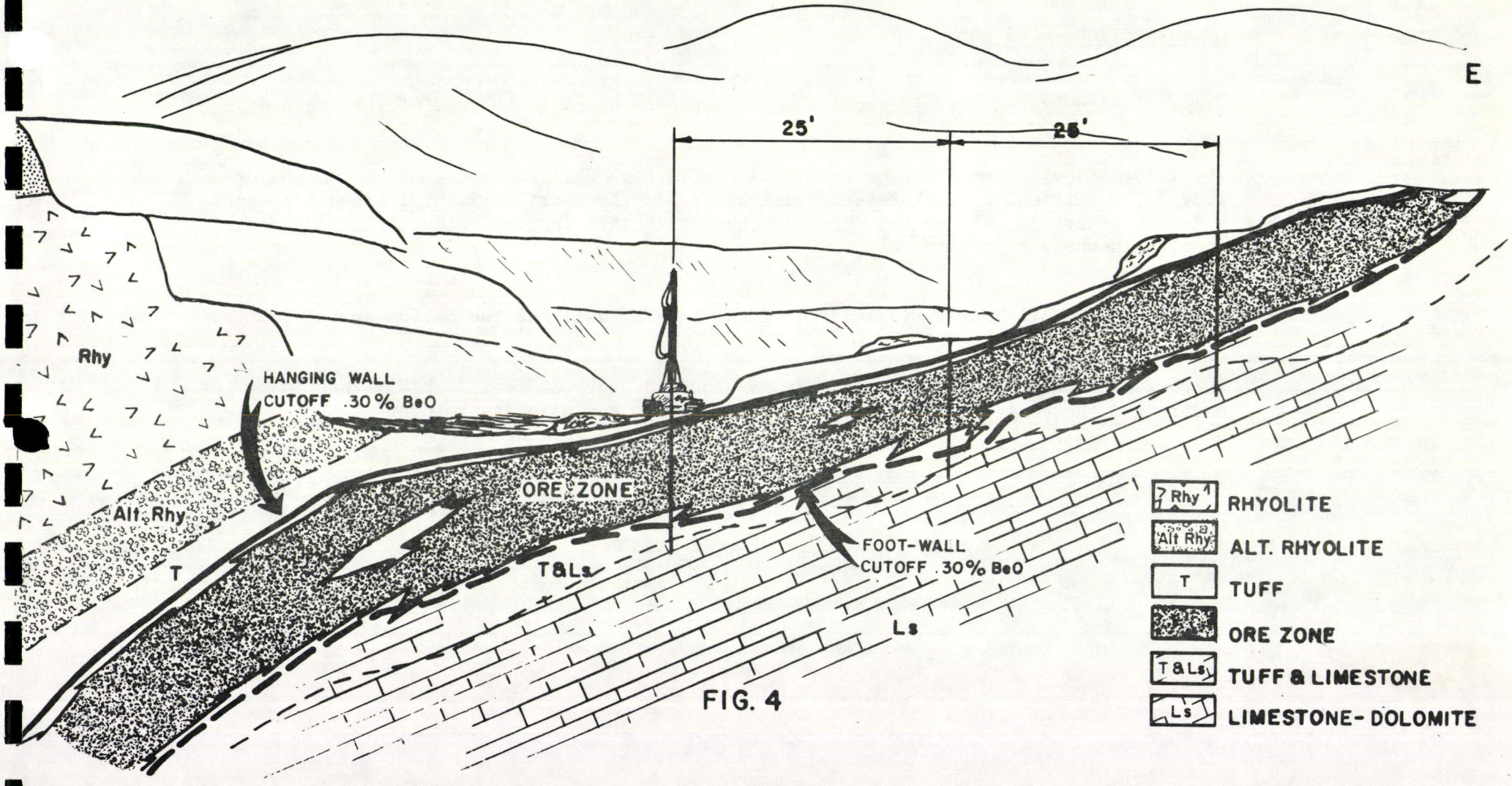


FIG. 4

CROSS-SECTION---ORE BODY

(Fig. 5) illustrates a cross-section representing a specific section of the ore body.

The information produced in the gridded areas is from drilling and sampling of the ore body. The vertical bars represent drill holes and the short horizontal lines represent a 2-foot interval. The number opposite the horizontal line indicates the grade of ore sampled in the 2-foot interval.

The top of the ore body is identified as the hanging wall and the bottom as the foot-wall.

A cross-sectional view of the ore body is produced every 25 feet. This is necessary to understand the configuration of the ore body and to maximize its recovery.

STOCKPILE DRILLING

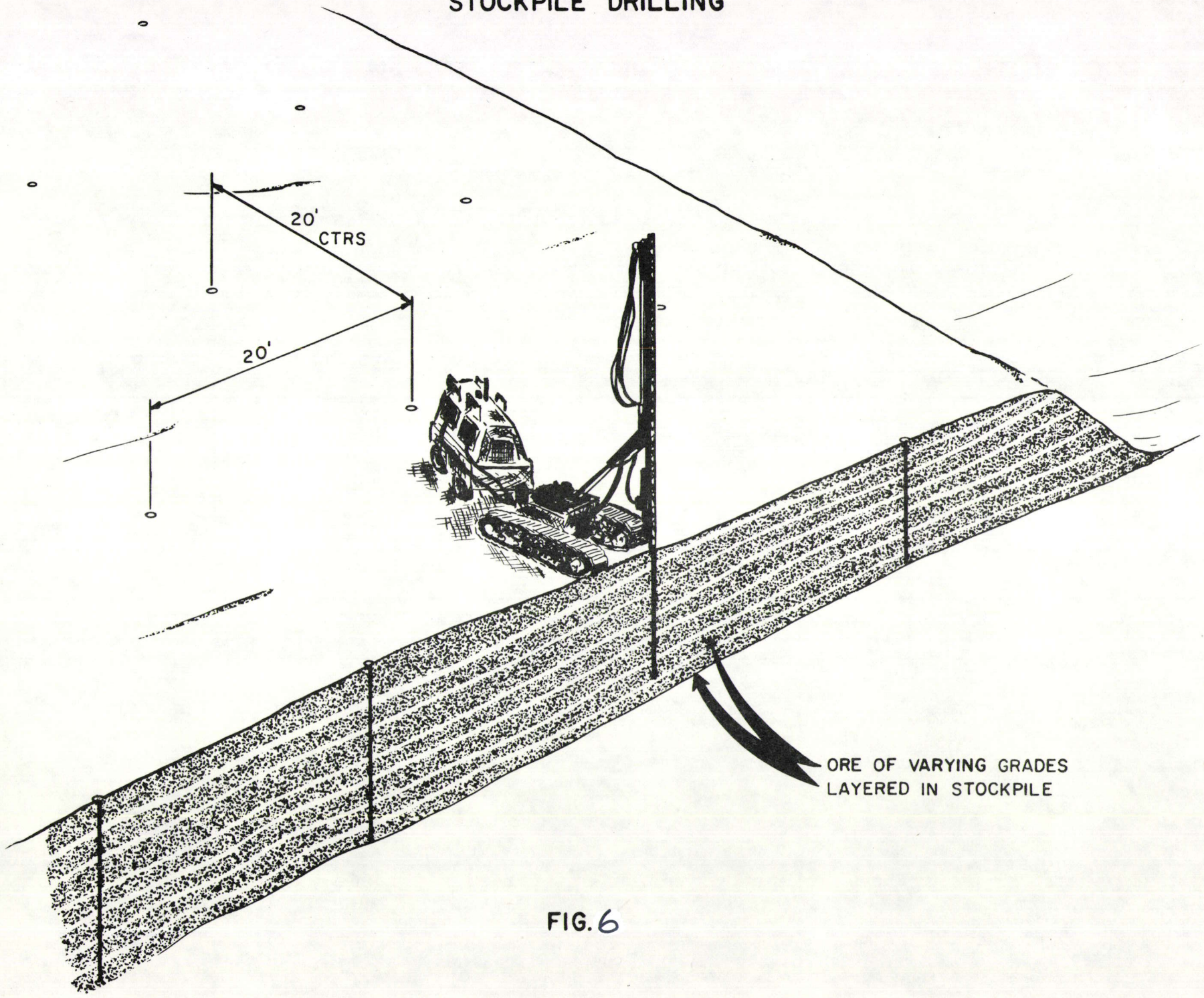


FIG. 6

SECONDARY STRIPPING
ORE QUALITY CONTROL
HANGING WALL

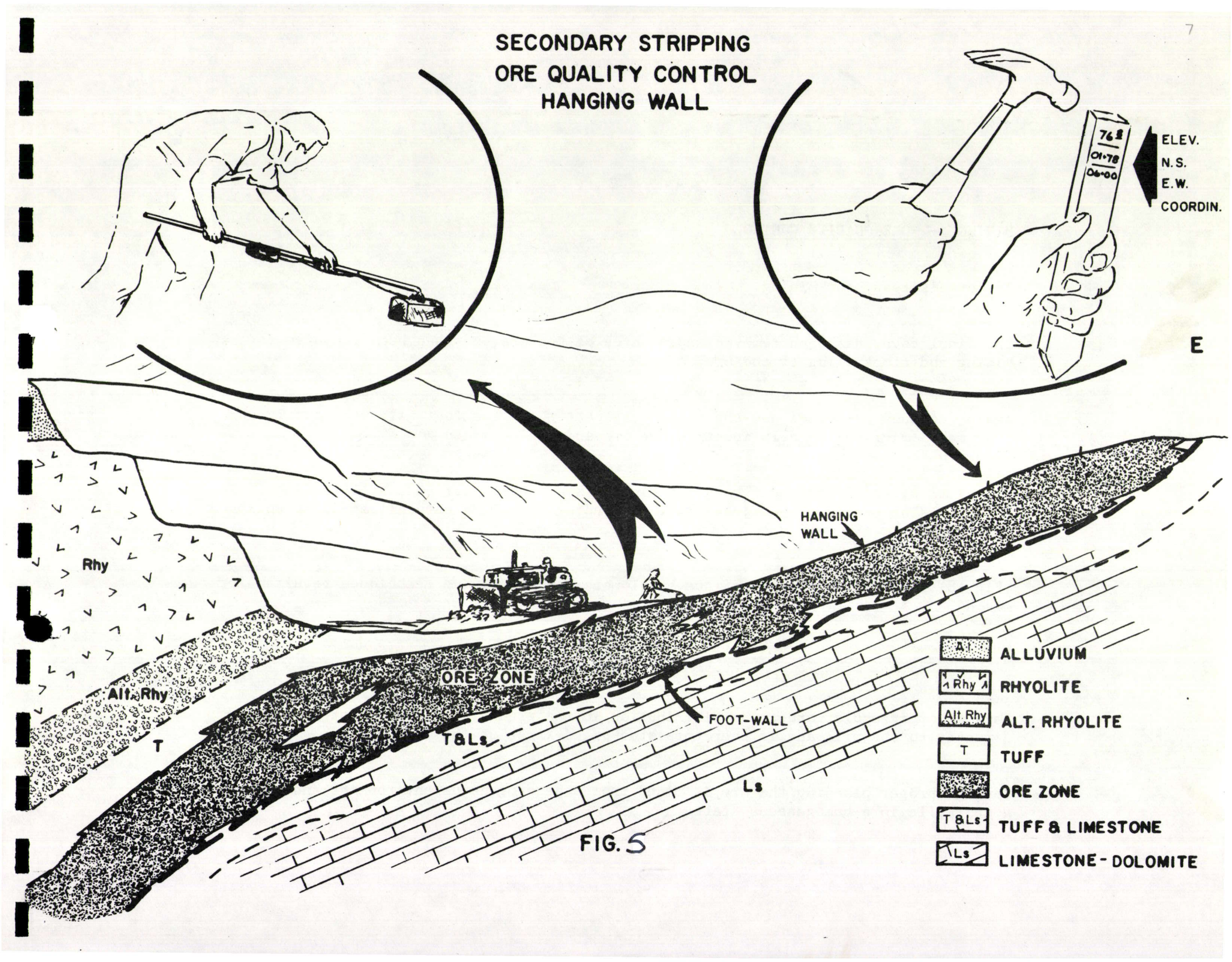


FIG. 5

MINING - ORE QUALITY CONTROL

The ore is ready for mining.

The final cover has been removed and an area of the ore body has been prepared for mining and stockpiling of the ore.

Again, company personnel use the field berylometer and the foot-wall structural contour map, (Fig. 6a) to help identify the ore body being mined.

A typical piece of equipment used for mining is a caterpillar 633, self-loading scraper. The ore is ripped just prior to loading by a D-8 caterpillar-dozer equipped with rippers.

(Fig. 8) illustrates the use of the berylometer and surveying techniques required for mining.

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Because of irregular ore grade distribution in the ground, the ore cannot be shipped directly to the mill and is therefore stockpiled first at the mine.

Through proper planning the ore is mined from a heterogeneous environment and blended in a stockpile in a homogeneous state.

rock berms to prevent vehicles and curious visitors from falling over the cliffs. The firm has agreed to engage in cooperative research with the Division in revegetation research during the life of the operations to best design the revegetation scheme.

III. DESCRIPTION OF EXISTING ENVIRONMENT:

(A) Topography and Surface Drainages

The proposed operations lie at elevations between 4800' and 5000'. The ground surface is developed on a colluvium and alluvium slope that rises onto an ill defined westward dipping hogback. This slope is sculptured into low hills and divides by the south-westward draining dry washes that head immediately to the east on the hogback for the Taurus Pit area and immediately to the northeast on low hills for the pit in Section 16. There are some ephemeral creeks that head a number of miles to the east on Spor Mountain, but these do not drain across the pit areas. (Fig.7)

(B) Climate

The area is quite arid with normal annual precipitation in the Thomas Range being less than 10 inches and the Fish Springs Flat area receiving less than 8 inches of rainfall. Most of the precipitation occurs during winter with 4-6 inches falling in the mountains and less than 4 inches in the valley. During the summer months, infrequent fronts and thunderstorms may drop about 3 inches in the mountains and less than that in the valley.

The mean maximum January temperature is about 36°F with the minimum temperature averaging about 14°F. The mean maximum and minimum temperatures for July are 90°F and 52°F respectively. This temperature regime amounts to a relatively long freeze-free season of 160 days with the mean end points for

the season falling on May 5th and October 12th. Another effect of the temperature regime is the relatively high mean annual evapo-transpiration potential of 27-30 inches.

(C) Ground Water

There is very little ground water data available for the area of this operation. It is similiar to other inter-mountain valleys in Western Utah as far as its geology and climate, so that certain similiarities in its ground water characteristics may be drawn.

The valley fill is probably hundreds of feet thick consisting of intertonguing deposits of fine sands, silts and clays deposited by Lake Bonneville along with marginal deposits of alluvial and colluvial origins. It is the marginal deposits that probably contribute the greatest recharge to the ground-water reservoir. This is due to runoff from the mountains during the winter and spring months when the surficial deposits are at their maximum saturation. This runoff percolates into the relatively porous marginal gravels and then moves down gradient to the center of the valley and then to the north.

The quality of the ground water probably decreases during its course through the valley fill due to the solution of salts in the fine silts and clays of Lake Bonneville origins. The better quality water is probably of the calcium or sodium bicarbonate types. The lower quality water is probably of the calcium sulphate or sodium chloride types.

There is little ground water utilization in Fish Springs Flat, with only a few wells along the southern margins and even fewer natural springs. There is an anomolous area of thermal springs (65-82^{o}F) known as Fish Springs 14 miles

northwest of the mines which supplies enough water to maintain the water fowl and wildlife refuge located there.

(D) Geology and Mining

The rocks of Spor Mountain are of Paleozoic age and consist of Ordovician to Devonian marine carbonate and clastic lithologies. They have been tilted to the west and intricately deformed by faults of Cenozoic age. By far, the geology of the area is dominated by extrusive igneous rocks of Tertiary age (Miocene-Pliocene?) that have been responsible for the mineralization in the area.

The igneous stratigraphy is complex, but generally is characterized by tuffs and welded tuffs (Miocene?) lying unconformably on the Paleozoics. On top of the paleotopography developed on these tuffs is the water-laid tuffs that contain the beryllium deposits (Pliocene?). These, in term, are over-laid by topaz-bearing rhyolite flows that make up the bulk of the Thomas Range and are responsible for the famous abundance of topaz crystals at Topaz Mountain. In the valleys surrounding the rock outcrops, the entire section is covered by lake deposits of the Lake Bonneville Group.

Previous mining has consisted of fluorspar and uranium production. The fluorspar was developed during 1943-1952 on Spor Mountain. It was mined from about 26 open trench and underground operations, generally from fluorspar breccia pipes that are thought to be the origin for the uranium, beryllium and fluorspar deposits. The fluorspar is uraniferous and is typically purple or reddish brown and approximately 75,000 tons was produced in total.

From 1956 to 1961, several thousand tons of uranium are averaging 0.1 percent U_3O_8 were produced from the Yellow Chief deposit at the south end of Spor Mountain.

The beryllium deposits have been largely developed by Brush, but Anaconda has developed a number of open pits and has attempted underground production of the ore with poor success.

(E) Vegetation

The natural vegetal development here is representative of the shadscale saltbush type. The stocking of perennial plants is sparse (estimated at 20% surface cover) in the undisturbed portions of the lease. Where surface disturbance has occured in recent years, invasion by halogeton is prolific, but is of little value except as an interception to the mechanical force of driving rain. Russian thistle is another invading annual which appears on disturbed areas.

Representative perennials of the lease area are, in order of decreasing occurance spiney hopsage, black sagebrush, broom snakeweed, rabbitbrush, shadscale, ephedra, indian ricegrass, big sagebrush and cacti.

(F) Recreation

A variety of recreational opportunities exist in the general vicinity of the mine. The most prevalent activity is rock and mineral collecting with the off road vehicle, hiking and camping activities associated with collecting.

The mine is not near any developed parks or major recreation attractions. Fish Springs National Wildlife Refuge is about 14 miles to the northwest and various Pony Express sites are to the north of the mine. These two attractions are remote and visitation is relatively low.

(G) Esthetics

The area in question is not particularly striking in scenic qualities. The mountains are low and dry while the flats are featureless and often prone to being windy and dusty. The mine site is in a Class III air quality area.

(H) Paleontological & Archeological

The local area of the mine is not a fossil collecting locality. The State Archeologist noted that there were no sites on the register for the local area in question.

(I) Range

The local area is used for sheep grazing. The vegetation and climate does not lend itself to heavy grazing utilization in the mine area. There are no range improvements or studies that would be disturbed by the proposed action.

(J) Wildlife

The wildlife resources of the mine area, as reported by the Division of Wildlife Resources, are small desert mammals, song birds, reptiles, birds of prey, coyotes, chukars and occasional antelope. Morning doves are found seasonally within the area. The local area is part of Herd Unit 62-A which also includes the Deep Creek Range. There are no deer harvest statistics for the mine area available.

(K) Soils

The soils in the general area of the mine belong to the Lithic Xerollic Calciorthids-Xerollic Calciorthids association and the Typic Calciorthid-Typic Torriorthents association. The bulk of those actually on the mining area belong in the latter group.

Moderate to strong alkalinity content characterize the latter groups surface layers as do yellowish-red, pale brown, and light brownish-gray colors. Surface soil textures range from very fine sandy loams to gravelly sandy loams, white subsoils are fine-loamy, fine-silty, course-loamy, and loamy-skeletal.

IV. PROBABLE IMPACTS ON EXISTING ENVIRONMENT:

(A) Topography & Surface Drainages

The mine will create a substantial impact on the landforms. The open pits will be left open. The pits will have a very steep highwall in solid rock with a rock safety berm along the top. The footwall side of each pit will be in a benched condition in rock which weathers fairly rapidly to a slope of about 45^{o}. The waste dumps will have flat tops and rounded slopes at angles less than 45^{o}.

The pits will collect seaonal runoff from small drainages that they intercept. In this arid region, this ponding of good quality water is a real resource that should balance the topographic impacts.

(B) Ground Water

The ponding affects of the pits may cause them to be seasonal, point recharges to the ground water resource.

(C) Geology & Mining

At the present time, there are no conflicts between mineral resources at the mine site. The nearby fluorspar and uranium mines are presently inactive and could be reactivated without any conflicts with the beryllium operation.

(D) Vegetation

The present vegetation will be lost in the areas of the pits and dumps. The company has committed itself to a trial revegetation program on the roads, dumps and footwalls of the pits. The Division and the company will cooperate in revegetation research during the life of the mine to establish the most successful scheme of revegetation. The species planted will be those that will stabilize the surface and also provide for grass and browse.

(E) Paleontological & Archeological

There are no known archeological sites that might be disturbed. The State Archeologist has been informed of the company's actions and timetable in case the area is to be surveyed for artifacts. Brush is cognizant of the possibilities for sites in the area and will report any sites to the State Archeologist.

(F) Recreation

There should be no adverse impacts on recreation caused by mining on the two sections in question. Rather, the field personell at the mine have accomodated many tourists who are curious, lost or out of gas. The good radio communication between the mine and the rest of the State is a real plus to the safety of those who do visit this remote part of the State.

(G) Wildlife

The mining activity will eliminate a small amount of natural habitat for the resident species. It should be noted that this general area has been extensively disturbed by previous mineral exploration and development, so that the future impacts

from mining in the two leases in question are additional to similiar present impacts.

The Division of Wildlife Resources has the opinion that impacts on wildlife will not be too serious and that the rainwater catchment in the new pits would likely offset impacts created by habitat disturbance.

(H) Range

The sheep grazing in the area of the new pits will be temporarily lost until reclamation of the dumps is complete at which time, this portion of the disturbed area will be returned to grazing use. The present runoff catchment in the existing pits is used by the local sheepmen for their sheep. The additional catchment in the new pits will be a welcome addition for this use.

(I) Soils

The soil in the area of the proposed pits and dumps is reletively thin and non-productive and will not be saved. The dumps will be covered with tuffacious rock which weathers rapidly to a sandy clay with a high proportion of clay. This material generally has a PH range of 7.5-8.4 which compares favorably with the PH of the original soil which is usually 7.9-8.2. The concentration of soluble salts in the dump material ranges between EC values of 2.7 to 9.1 which compares favorably with the natural soil salinity of 4-16. In general, revegetation of the dumps and pit footwalls to approximately the pre-mining vegetation will depend upon the addition of some soil amendments, proper planting techniques and timing and grazing control.

(J) Esthetics

The natural land forms will be permanently disrupted. The gently rolling terrain will be partially flattened by dumps. The pits will remain open. All machinery, buildings, and debris will be removed from the surface by the firm upon abandonment of the entire operation.
After reclamation, the visual impacts will be minimal and probably less than the present visual impacts of the abandoned fluorspar and uranium mines in the nearby area.

(K) Socio-Economic

Development of the proposed mines will not alter the present socio-economic impact of the present mining operation. A small, set number of mine employees have been with the operation for years and this group is not likely to be changed appreciably by the proposed actions. There should be no appreciable economic impact to the nearby communities.

V. ALTERNATIVES TO THE PROPOSED ACTION:

(A) No Action

No action would mean recommending not to mine the beryllium ore known to exist in these two leases. This would force the firm to mine less desirable tracts on land under its control in the nearby area. The impacts would merely be shifted in location. This action is unjustifiable.

(B) Permit Mining of the Leases with no Environmental Constraints

This alternative would maximize corporate profits, but would transfer the environmental damage costs to future generations. The costs of reclamation for the areas in question are small compared to the value of the ore produced and the firm is bound by law to reclaim the land affected.

(C) Permit Mining of the Leases with Specific Contraints

This alternative is one that will allow valuable mineral production and environmental protection. The Utah Mined Land Reclamation Act already stipulates certain constraints and the administration of this law by the Division allows additional constraints to be considered from concerned agencies and citizens. Specific constraints imposed by the Division and corporate commitments are included in the reclamation plan which is open for inspection at the Division office.

VI. SHORT TERM VRS. LONG TERM COMMITMENT OF RESOURCES:

The beryllium ore to be mined is an irretrievable resource. Once extracted for present needs, it is gone for all future generations. The temporary loss of grazing land is a short term commitment. As much of the disturbed land as is practically possible will be returned to range and wildlife use.

VII. MITIGATIVE MEASURES TO BE UTILIZED:

(A) Spoil dumps will be regraded and reclaimed.

(B) Debris, scrap, wood and buildings will be removed from the surface.

(C) Pit highwalls will be isolated by a permanent barrier of rock.

(D) Safe access to the pits will be left for access to the seasonal runoff water that is trapped.

(E) Pre-existing roads will be left open.